Complete Summary

TITLE

Pneumonia: thirty-day all-cause risk standardized readmission rate following pneumonia hospitalization.

SOURCE(S)

Specifications manual for national hospital inpatient quality measures, version 3.0b. Centers for Medicare & Medicaid Services (CMS), The Joint Commission; 2009 Oct. various p.

Measure Domain

PRIMARY MEASURE DOMAIN

Outcome

The validity of measures depends on how they are built. By examining the key building blocks of a measure, you can assess its validity for your purpose. For more information, visit the Measure Validity page.

SECONDARY MEASURE DOMAIN

Does not apply to this measure

Brief Abstract

DESCRIPTION

This measure* is used to assess hospital-specific 30-day all-cause risk-standardized readmission rate (RSRR) following hospitalization for pneumonia among Medicare beneficiaries aged 65 years or older at the time of index hospitalization.

*This is a Centers for Medicare & Medicaid Services (CMS) only measure.

RATIONALE

Centers for Medicare & Medicaid Services (CMS) developed the pneumonia 30-day readmission measure to complement the existing pneumonia process-of-care and mortality measures. Risk-standardized readmission rates (RSRRs) can provide important additional information about quality of care that is currently not captured by the process and mortality measures and is currently unavailable to

hospitals. Variation in readmission, after adjusting for case mix, may reflect differences in hospitals' general environments (such as coordination of care, patient safety policies, and staffing) or variation in care processes not measured in the current core measure set. Outcome measures can focus attention on a broader set of healthcare activities that affect patients' well being. Moreover, improving outcomes is the ultimate goal of quality improvement, and thus the inclusion of outcomes measures assists in attaining improvement goals.

Readmission of patients who were recently discharged after hospitalization with pneumonia represents an important, expensive, and often preventable adverse outcome. The risk of readmission can be modified by the quality and type of care provided to these patients. Improving readmission rates is the joint responsibility of hospitals and clinicians. Measuring readmission will create incentives to invest in interventions to improve hospital care, better assess the readiness of patients for discharge, and facilitate transitions to outpatient status. This measure is also responsive to the recent call by the Medicare Payment Advisory Commission (MedPAC) to develop readmission measures, with pneumonia highlighted as one of seven conditions that account for nearly 30% of potentially preventable readmissions in the 15-day window after initial hospital discharge (MedPAC, 2007).

PRIMARY CLINICAL COMPONENT

Pneumonia; 30-day all-cause readmission rate

DENOMINATOR DESCRIPTION

Admissions for Medicare fee-for-service beneficiaries aged greater than or equal to 65 years with a principal discharge diagnosis of pneumonia* and with a complete claims history for 12 months prior to admission (see the related "Denominator Inclusions/Exclusions" field in the Complete Summary)

The hospital-specific risk-standardized readmission rate (RSRR) is calculated as the ratio of predicted to expected readmissions, multiplied by the national unadjusted rate. The "denominator" of the ratio component is the expected number of readmissions for each hospital within 30 days given the hospital's case mix.

*International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM) codes that define the patient cohort:

- 480.0: Pneumonia due to adenovirus
- 480.1: Pneumonia due to respiratory syncytial virus
- 480.2: Pneumonia due to parainfluenza virus
- 480.3: Pneumonia due to SARS-associated coronavirus
- 480.8: Viral pneumonia: pneumonia due to other virus not elsewhere classified
- 480.9: Viral pneumonia unspecified
- 481: Pneumococcal pneumonia [streptococcus pneumoniae pneumonia]
- 482.0: Pneumonia due to klebsiella pneumoniae
- 482.1: Pneumonia due to pseudomonas
- 482.2: Pneumonia due to hemophilus influenzae (h. influenzae)

- 482.30: Pneumonia due to streptococcus unspecified
- 482.31: Pneumonia due to streptococcus group a
- 482.32: Pneumonia due to streptococcus group b
- 482.39: Pneumonia due to other streptococcus
- 482.40: Pneumonia due to staphylococcus unspecified
- 482.41: Pneumonia due to staphylococcus aureus
- 482.49: Other staphylococcus pneumonia
- 482.81: Pneumonia due to anaerobes
- 482.82: Pneumonia due to escherichia coli [e.coli]
- 482.83: Pneumonia due to other gram-negative bacteria
- 482.84: Pneumonia due to legionnaires' disease
- 482.89: Pneumonia due to other specified bacteria
- 482.9: Bacterial pneumonia unspecified
- 483.0: Pneumonia due to mycoplasma pneumoniae
- 483.1: Pneumonia due to chlamydia
- 483.8: Pneumonia due to other specified organism
- 485: Bronchopneumonia organism unspecified
- 486: Pneumonia organism unspecified
- 487.0: Influenza with pneumonia

Note: We do not include 410.x2 (AMI, subsequent episode of care).

Note: Hierarchical logistic regression modeling is used to calculate a hospital-specific risk RSRR. This rate is calculated as the ratio of "predicted" to "expected" readmissions, multiplied by the national unadjusted rate. For each hospital, the "numerator" of the ratio component of the RSRR is the predicted number of readmissions within 30 days given the hospital's performance with its observed case mix, and the "denominator" is the expected number of readmissions given the hospital's case mix. By convention, we use the term "predicted" here to describe the numerator result, which is calculated using the hospital-specific intercept term. We use "expected" for the denominator, which is calculated using the average intercept term. See the 2009 Measures Maintenance Technical Report: Acute Myocardial Infarction, Heart Failure, and Penumonia 30-Day Risk-standardized Readmission Measures for more details.

NUMERATOR DESCRIPTION

The hospital-specific risk-standardized readmission rate (RSRR) is calculated as the ratio of predicted to expected readmissions, multiplied by the national unadjusted rate. The "numerator" of the ratio component is the predicted number of readmissions for each hospital within 30 days given the hospital's performance with its observed case mix.

Note: This outcome measure does not have a traditional numerator and denominator like a core process measure (e.g., percentage of adult patients with diabetes aged 18-75 years receiving one or more hemoglobin A1c tests per year); thus, we are using this field to define our statistically-adjusted outcome measure.

Hierarchical logistic regression modeling is used to calculate a hospital-specific RSRR. This rate is calculated as the ratio of "predicted" to "expected" readmissions, multiplied by the national unadjusted rate. For each hospital, the "numerator" of the ratio component of the RSRR is the predicted number of readmissions within 30 days given the hospital's performance with its observed case mix, and the "denominator" is the expected number of readmissions given the hospital's case mix. By convention, we use the term "predicted" here to describe the numerator result, which is calculated using the hospital-specific intercept term. We use "expected" for the denominator, which is calculated using the average intercept term.

More specifically, the expected number of readmissions in each hospital is estimated using its patient mix and the average hospital-specific intercept. The predicted number of readmissions in each hospital

is estimated given the same patient mix but an estimated hospital-specific intercept. Operationally, the expected number of readmissions for each hospital is obtained by regressing the risk factors on the readmission outcome using all hospitals in our sample, applying the subsequent estimated regression coefficients to the patient characteristics observed in the hospital, adding the average of the hospital-specific intercepts, transforming, and then summing over all patients in the hospital to get a value. This is a form of indirect standardization. The predicted hospital outcome is the number of readmissions in the "specific" hospital estimated given its performance and case mix. Operationally, this is accomplished by estimating a hospital-specific intercept that herein represents baseline readmission risk within the hospital, applying the estimated regression coefficients to the patient characteristics in the hospital, transforming, and then summing over all patients in the hospital to get a value. To assess hospital performance in any reporting period, we re-estimate the model coefficients using the years of data in that period.

See the "Description of Allowance for Patient Factors" field in the Complete Summary for risk adjustment details. See the 2009 Measures Maintenance Technical Report: Acute Myocardial Infarction, Heart Failure, and Penumonia 30-Day Risk-standardized Readmission Measures for more details.

Evidence Supporting the Measure

EVIDENCE SUPPORTING THE CRITERION OF QUALITY

- One or more research studies published in a National Library of Medicine (NLM) indexed, peer-reviewed journal

Evidence Supporting Need for the Measure

NEED FOR THE MEASURE

Variation in quality for the performance measured

EVIDENCE SUPPORTING NEED FOR THE MEASURE

Specifications manual for national hospital inpatient quality measures, version 3.0b. Centers for Medicare & Medicaid Services (CMS), The Joint Commission; 2009 Oct. various p.

State of Use of the Measure

STATE OF USE

Current routine use

CURRENT USE

Collaborative inter-organizational quality improvement
External oversight/Medicare
Internal quality improvement
National reporting

CARE SETTING

Hospitals

PROFESSIONALS RESPONSIBLE FOR HEALTH CARE

Measure is not provider specific

LOWEST LEVEL OF HEALTH CARE DELIVERY ADDRESSED

Single Health Care Delivery Organizations

TARGET POPULATION AGE

Age greater than or equal to 65 years

TARGET POPULATION GENDER

Either male or female

STRATIFICATION BY VULNERABLE POPULATIONS

Unspecified

Characteristics of the Primary Clinical Component

INCIDENCE/PREVALENCE

Unspecified

ASSOCIATION WITH VULNERABLE POPULATIONS

Unspecified

BURDEN OF ILLNESS

Pneumonia is the second most common principal hospital discharge diagnosis among Medicare beneficiaries, and, in 2005, it was the third most expensive condition billed to Medicare (Andrews and Elixhauser, 2007). Readmission rates following discharge for pneumonia are high. For example, rates of all-cause readmission at 30 days have been found to range from 10% (Baker et al., 2004) to 24% (Vecchiarino et al., 2004).

Readmission rates are influenced by the quality of inpatient and outpatient care, the availability and use of effective disease management programs, and the bed capacity of the local health care system. Some of the variation in readmissions may be attributable to delivery system characteristics (Fisher et al., 1994). Also,

interventions during and after a hospitalization can be effective in reducing readmission rates in geriatric populations (Benbassat and Taragin, 2000; Naylor et al., 1999; Coleman et al., 2006). Moreover, such interventions can be cost saving (Coleman et al., 2006; Naylor et al., 1999). In the case of pneumonia specifically, studies suggest that appropriate care for pneumonia during the index hospitalization may reduce the risk of subsequent readmission (Dean et al., 2006; Gleason et al., 1999). Tracking readmissions also emphasizes improvement in care transitions and care coordination. Although discharge planning is required by Medicare as a condition of participation for hospitals, transitional care focuses more broadly on "hand-offs" of care from one setting to another, and may have implications for quality and costs (Coleman, 2005).

The Medicare Payment Advisory Commission (MedPAC) has called for hospital-specific public reporting of readmission rates, identifying pneumonia as one of seven conditions that account for nearly 30% of potentially preventable readmissions in the 15-day window after initial hospital discharge (MedPAC, 2007). MedPAC finds that readmissions are common, costly, and often preventable. Based on 2005 Medicare data, MedPAC estimates that about 9.5% of Medicare pneumonia admissions were followed by a potentially preventable readmission within 15 days, accounting for over 74,000 admissions at a cost of $533 million.

EVIDENCE FOR BURDEN OF ILLNESS

Andrews RM, Elixhauser A. The national hospital bill: growth trends and 2005 update on the most expensive conditions by payer. Rockville (MD): Agency for Healthcare Research and Quality (AHRQ); 2007 Dec. (HCUP statistical brief; no. 42).

Baker DW, Einstadter D, Husak SS, Cebul RD. Trends in postdischarge mortality and readmissions: has length of stay declined too far. Arch Intern Med2004 Mar 8;164(5):538-44. PubMed

Benbassat J, Taragin M. Hospital readmissions as a measure of quality of health care: advantages and limitations. Arch Intern Med2000 Apr 24;160(8):1074-81. PubMed

Coleman EA, Parry C, Chalmers S, Min SJ. The care transitions intervention: results of a randomized controlled trial. Arch Intern Med2006 Sep 25;166(17):1822-8. PubMed

Coleman EA. Background paper on transitional care performance measurement. Appendix I. In: Institute of Medicine, performance measurement: accelerating improvement. Washington (DC): National Academy Press; 2005.

Dean NC, Bateman KA, Donnelly SM, Silver MP, Snow GL, Hale D. Improved clinical outcomes with utilization of a community-acquired pneumonia guideline. Chest2006 Sep;130(3):794-9. PubMed

Fisher ES, Wennberg JE, Stukel TA, Sharp SM. Hospital readmission rates for cohorts of Medicare beneficiaries in Boston and New Haven. N Engl J Med1994 Oct 13;331(15):989-95. PubMed

Gleason PP, Meehan TP, Fine JM, Galusha DH, Fine MJ. Associations between initial antimicrobial therapy and medical outcomes for hospitalized elderly patients with pneumonia. Arch Intern Med1999 Nov 22;159(21):2562-72. PubMed

Medicare Payment Advisory Commission (MeDPAC). Report to congress: promoting greater efficiency in Medicare. Medicare Payment Advisory Commission (MeDPAC); 2007.

Naylor MD, Brooten D, Campbell R, Jacobsen BS, Mezey MD, Pauly MV, Schwartz JS. Comprehensive discharge planning and home follow-up of hospitalized elders: a randomized clinical trial. JAMA1999 Feb 17;281(7):613-20. PubMed

Vecchiarino P, Bohannon RW, Ferullo J, Maljanian R. Short-term outcomes and their predictors for patients hospitalized with community-acquired pneumonia. Heart Lung2004 Sep-Oct;33(5):301-7. PubMed

UTILIZATION

See the "Burden of Illness" field.

COSTS

See the "Burden of Illness" field.

Institute of Medicine National Healthcare Quality Report Categories

IOM CARE NEED

Getting Better

IOM DOMAIN

Effectiveness

Data Collection for the Measure

CASE FINDING

Users of care only

DESCRIPTION OF CASE FINDING

Admissions for Medicare fee-for-service beneficiaries aged greater than or equal to 65 years with a principal discharge diagnosis of pneumonia and with a complete claims history for 12 months prior to admission (see the "Denominator

Inclusions/Exclusions" field for a list of all International Classification of Diseases, Ninth Revision, Clinical Modification [ICD-9-CM] codes for pneumonia)

DENOMINATOR SAMPLING FRAME

Patients associated with provider

DENOMINATOR INCLUSIONS/EXCLUSIONS

Inclusions
Admissions for Medicare fee-for-service beneficiaries aged greater than or equal to 65 years with a principal discharge diagnosis of pneumonia* and with a complete claims history for 12 months prior to admission

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Exclusions
Cohort exclusions (excluded admissions):

- Admissions for patients with an in-hospital death are excluded because they are not eligible for readmission.
- Admissions for patients having a principal diagnosis of pneumonia during the index hospitalization and subsequently transferred to another acute care facility are excluded because we are focusing on discharges to non-acute care settings.
- Admissions for patients who are discharged against medical advice (AMA) are excluded because providers did not have the opportunity to deliver full care and prepare the patient for discharge.
- Admissions for patients without at least 30 days post-discharge enrollment in fee-for-service Medicare are excluded because the 30-day readmission outcome cannot be assessed in this group.
- If a patient has one or more additional pneumonia admissions within 30 days of discharge from an index pneumonia admission, we do not consider the additional pneumonia admissions as index admissions (they are considered as readmissions). Thus, any pneumonia admission is either an index admission or a readmission, but not both.

RELATIONSHIP OF DENOMINATOR TO NUMERATOR

All cases in the denominator are equally eligible to appear in the numerator

DENOMINATOR (INDEX) EVENT

Clinical Condition
Institutionalization

DENOMINATOR TIME WINDOW

Time window brackets index event

NUMERATOR INCLUSIONS/EXCLUSIONS

Inclusions
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See the "Description of Allowance for Patient Factors" field in the Complete Summary for risk adjustment details. See the 2009 Measures Maintenance Technical Report: Acute Myocardial Infarction, Heart Failure, and Penumonia 30-Day Risk-standardized Readmission Measures for more details.

Exclusions
Unspecified

MEASURE RESULTS UNDER CONTROL OF HEALTH CARE PROFESSIONALS, ORGANIZATIONS AND/OR POLICYMAKERS

The measure results are somewhat or substantially under the control of the health care professionals, organizations and/or policymakers to whom the measure applies.

NUMERATOR TIME WINDOW

Fixed time period

DATA SOURCE

Administrative data

LEVEL OF DETERMINATION OF QUALITY

Not Individual Case

OUTCOME TYPE

Adverse Outcome

PRE-EXISTING INSTRUMENT USED

Unspecified

Computation of the Measure

SCORING

Rate

INTERPRETATION OF SCORE

Better quality is associated with a lower score

ALLOWANCE FOR PATIENT FACTORS

Risk adjustment devised specifically for this measure/condition

DESCRIPTION OF ALLOWANCE FOR PATIENT FACTORS

The approach to risk adjustment is tailored to and appropriate for a publicly reported outcome measure, as articulated in the American Heart Association (AHA) Scientific Statement, "Standards for Statistical Models Used for Public Reporting of Health Outcomes" (Krumholz et al., 2006).

A hierarchical logistic regression model was developed to estimate the log-odds of readmission within 30 days of an pneumonia index admission as a function of patient demographic and clinical characteristics. The model includes a random hospital-specific intercept to account for within-hospital correlation of the observed outcomes. This assumes that underlying differences in quality among the hospitals being evaluated lead to systematic differences in outcomes.

Candidate and Final Variables: Candidate variables were patient-level risk-adjustors that are expected to be predictive of readmission, based on empirical analysis, prior literature, and clinical judgment, including demographic factors (age, sex) and indicators of comorbidity and disease severity. Refer to the original measure documentation for the final set of risk-adjustment variables included.

The final set of risk-adjustment variables included:

Demographic	- Age-65 (years above 65, continuous) - Male
Comorbidity	- History of coronary artery bypass graft (CABG) surgery - History of infection - Septicemia/shock - Metastatic cancer and acute leukemia - Lung, upper digestive tract, and other severe cancers - Lymphatic, head and neck, brain, and other major cancers; breast, prostate, colorectal and other cancers and tumors - Diabetes mellitus (DM) and DM complications - Protein-calorie malnutrition - Disorders of fluid/electrolyte/acid-base - Other gastrointestinal disorders - Severe hematological disorders - Iron deficiency and other/unspecified anemias and blood disease - Dementia and senility - Drug/alcohol abuse/dependence/psychosis

- Major psychiatric disorders
- Other psychiatric disorders
- Hemiplegia, paraplegia, paralysis, functional disability
- Cardio-respiratory failure and shock
- Congestive heart failure
- Acute coronary syndrome
- Chronic atherosclerosis
- Valvular and rheumatic heart disease
- Arrhythmias
- Stroke
- Vascular or circulatory disease
- Chronic obstructive pulmonary disease (COPD)
- Fibrosis of lung and other chronic lung disorders
- Asthma
- Pneumonia
- Pleural effusion/pneumothorax
- Other lung disorders
- End-stage renal disease or dialysis
- Renal failure
- Urinary tract infection
- Other urinary tract disorders
- Decubitus ulcer or chronic skin ulcer
- Vertebral fractures
- Other injuries

Full details of the development of the risk-standardization model for this measure are available at www.qualitynet.org.

STANDARD OF COMPARISON

External comparison at a point in time
External comparison of time trends
Internal time comparison

Evaluation of Measure Properties

EXTENT OF MEASURE TESTING

To evaluate the performance of the model used for 2009 reporting, we fit the revised model to three single-year datasets (2005, 2006, and 2007) and to the combined three-year 2005-2007 calendar year dataset. We re-estimated the model variable coefficients and examined the model performance in each of these datasets. We also examined trends in the frequency of patient risk factors.

Specifically, we:

- Assessed generalized linear model (GLM) performance in terms of discriminant and predictive ability and overall fit for each of the single-year datasets (2005, 2006, and 2007) and for the combined 2005-2007 calendar year dataset.

- Fitted hierarchical generalized linear models (HGLMs) for the same datasets and compared both fixed-effect estimates and hospital-level covariance estimates across the different time periods.

We additionally assessed the performance of the measure using preliminary data for admissions with discharges between July 1, 2005, and June 30, 2008. The results were substantively similar to those for the 2005-2007 calendar year dataset (data not shown). We computed two summary statistics for assessing model performance: the adjusted R^2, which indicates the percentage of the variation in the outcome explained by the model variables, and the area under the receiver operating characteristic (ROC) curve (c-statistic), which is an indicator of the model's discriminant ability or ability to correctly classify those who are and are not readmitted within 30 days (values range from 0.5 meaning no better than chance to 1.0 meaning perfect discrimination). The adjusted R^2 remained constant at 5.0% across the study period. The area under the ROC curve (c-statistic) remained constant at 0.63. For the model using the 2005-2007 calendar year dataset, the observed readmission rate was 9.1% among patients in the lowest predicted decile and 32.3% among patients in the highest predicted decile, a range of 23.2%.

Examining the overall distribution of the risk-standardized readmission rate (RSRR) based on the 2005-2007 calendar year dataset, the 25th and 75th percentiles were 17.0% and 19.1%, respectively. The odds of all-cause readmission if treated at a hospital one standard deviation above the national average was 1.41 times higher than the odds of all-cause readmission if treated at a hospital one standard deviation below the national average. If there were no systematic differences between hospitals, the between-hospital variance would be zero and the odds ratio would be 1.0.

EVIDENCE FOR RELIABILITY/VALIDITY TESTING

Desai MM, Lin Z, Schreiner GC, Wang Y, Grady JN, Duffy CO, Grosso LM, Turkmani D, Wang Y, Gao J, Normand SL, Drye EE, Krumholz HM. 2009 Measures maintenance technical report: acute myocardial infarction, heart failure, and pneumonia 30-day risk-standardized readmission measures. Baltimore (MD): Centers for Medicare & Medicaid Services; 2009 Apr 7. 46 p.

Identifying Information

ORIGINAL TITLE

READM-30-PN: Thirty-day all-cause risk standardized readmission rate following pneumonia hospitalization.

MEASURE COLLECTION

National Hospital Inpatient Quality Measures

MEASURE SET NAME

CMS Readmission Measures

SUBMITTER

Centers for Medicare & Medicaid Services
Joint Commission, The

DEVELOPER

Centers for Medicare & Medicaid Services/The Joint Commission
Yale-New Haven Health Systems Corporation/Center for Outcomes Research and
Evaluation under contract to Centers for Medicare & Medicaid Services

FUNDING SOURCE(S)

Centers for Medicare & Medicaid Services (CMS)

COMPOSITION OF THE GROUP THAT DEVELOPED THE MEASURE

This measure was developed by a team of clinical and statistical experts from Yale
University/Yale-New Haven Hospital Center for Outcomes Research and Evaluation
(Yale-CORE) and Harvard University, through a Centers for Medicare & Medicaid
Services (CMS) contract with the Colorado Foundation for Medicare Care (CFMC).

FINANCIAL DISCLOSURES/OTHER POTENTIAL CONFLICTS OF INTEREST

Unspecified

ENDORSER

National Quality Forum

INCLUDED IN

Hospital Compare
Hospital Quality Alliance

ADAPTATION

Measure was not adapted from another source.

RELEASE DATE

2009 Oct

MEASURE STATUS

This is the current release of the measure.

SOURCE(S)

Specifications manual for national hospital inpatient quality measures, version 3.0b. Centers for Medicare & Medicaid Services (CMS), The Joint Commission; 2009 Oct. various p.

MEASURE AVAILABILITY

The individual measure, "READM-30-PN: Thirty-day All-cause Risk Standardized Readmission Rate Following Pneumonia Hospitalization," is published in "Specifications Manual for National Hospital Inpatient Quality Measures." This document is available from The Joint Commission Web site. Information is also available from the QualityNet Web site and the Hospital Compare Web site. Check The Joint Commission Web site and QualityNet Web site regularly for the most recent version of the specifications manual and for the applicable dates of discharge.

NQMC STATUS

This NQMC summary was completed by ECRI Institute on July 13, 2009. The information was verified by the measure developer on December 29, 2009.

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